REMARKS

This response is intended as a complete response to the Final Office Action dated September 7, 2007. In view of the following discussion, the Applicants believe that all claims are in allowable form.

CLAIM REJECTIONS

A. 35 USC §103 Claims 1-2, 4-5, 7-10 and 42; 11-12, 15-16, 18-21 and 43

Claims 1-2, 4-5, 7-10 and 42; 11-12, 15-16, 18-21 and 43 stand rejected as being unpatentable over United States Patent No. 5,835,221 issued November 10, 1998, to *Lee, et al.* (hereinafter *Lee*) in view of United States Patent No. 5,131,752 issued July 21, 1992 to *Yu et al.* (hereinafter *Yu*). Applicants respectfully disagree.

Independent claims 1 and 11 recite limitations not taught or suggested by the combination of *Lee* and *Yu*. *Lee* discloses providing a substrate comprising a material layer having an initial thickness on the order of 1000's of Angstroms, etching the material layer on the substrate, directing radiation having wavelengths on the order of hundreds of nanometers onto the substrate as the material layer is etched, measuring a change in intensity for radiation reflected from the substrate at a pre-selected wavelength, and terminating the etch step upon measuring a predetermined metric for the change in intensity radiation reflected from the substrate at the pre-selected wavelength. (*Lee*, Figures 2-3 and corresponding text.)

However, *Lee* fails to teach or suggest etching a high-k dielectric material layer, as recited in claim 1; or a high-k gate dielectric layer, as recited in claim 11. The Examiner asserts that the oxide layer of *Lee* is the same at the high-k layers claimed by the Applicants. However, the Examiner has not cited any references nor provided any line of reasoning as to why the silicon oxide of *Lee* is equivalent to a high-k dielectric material as recited in the present claims.

Moreover, as the Examiner admits, *Lee* fails to teach or suggest a process including directing radiation onto the substrate as the material layer is etched, wherein the radiation has a wavelength in nanometers that is on the order of the initial thickness of the material layer in Angstroms, as recited in claim 1; or directing radiation onto the substrate as the gate dielectric layer is etched, wherein the radiation has a wavelength

in nanometers that is on the order of the initial thickness of the gate dielectric layer in Angstroms, as recited in claim 11.

Yu teaches a different method for film thickness endpoint control using an ellipsometer that derives delta and psi coordinates of a polarized beam of light reflected from a workpiece during processing. (*Yu*, Abstract.) Specifically, *Yu* teaches a method of detecting a process endpoint by:

> [selecting] an unbounded control line 100 …passing through the pre-computed endpoint 70.… [The d]irection of unbounded control line 100 can be selected to extend in [a] desired transverse direction by …select[ing] a second film thickness slightly greater than the film thickness defined by endpoint 70, such as a second film thickness represented at a point 102. …The unbounded control line 100 is then selected as a straight line having a direction perpendicular to a line 104 between the target endpoint 70 and the second film thickness point 102. …A function of delta and psi, F (delta, psi), is chosen such that the function is zero (F (delta, psi)=0) for all points on the unbounded control line 100. Effectively the chosen function defines the control line. The line is the locus of points for which the chosen function is zero. Thus one can simply calculate the value of this function of measured delta and psi values, Dm and Pm, and stop the process when the value of the function is sufficiently close to zero. Preferably the process is stopped when the value of the function changes sign. (*Id.*, col 8, l. 37 – col. 9, l. 12.)

Yu discloses one example of growing a 400 Angstrom silicon dioxide film while utilizing endpoint control techniques including a light having a 6,328 Angstrom wavelength. (*Id.*, col. 7, ll. 7-40.) The Examiner asserts that it would be obvious to Modify the teachings of *Lee* by using *Yu's* method of endpoint control for precisely stopping when a film thickness has attained a desired value. (*Final Office Action*, p. 4, citing *Yu*, col. 6, ll. 9-11.)

However, even if one where to combine the teachings of *Lee* and *Yu* as asserted by the Examiner, the resultant combination would still not yield the limitations recited in the present claims. Specifically, *Yu* teaches a particular endpoint control methodology. The benefit cited by the Examiner is stated by *Yu*, "A fundamental advantage of the present invention is to enable the process to be precisely stopped when film thickness has attained a desired value." (*Yu*, col. 6, ll. 9-11.) As such, one wishing to obtain this benefit would utilize the endpoint detection methodology taught by *Yu* in place of the endpoint detection methodology taught by *Lee*.

Therefore, the combination of *Lee* and *Yu* would result in a method using an ellipsometer that derives delta and psi coordinates of a polarized beam of light reflected from a workpiece and calculates a control line passing through a pre-determined endpoint as taught by *Yu*. Such a methodology still fails to yield a process including measuring a change in intensity for radiation reflected from the substrate at a pre-selected wavelength as the material layer is etched and terminating the etch step upon measuring a predetermined metric for the change in intensity of radiation reflected from the substrate at the pre-selected wavelength, as recited in claim 1; or measuring a change in intensity for radiation reflected from the substrate at a pre-selected wavelength as the gate dielectric layer is etched; and terminating the etch step upon measuring a predetermined metric for the change in intensity of radiation reflected from the substrate at the pre-selected wavelength, as recited in claim 11.

As such, a *prima facie* case of obviousness has not been established because the combination of *Lee* and *Yu* fails to yield the limitations recited in claims 1 and 11.

Thus, claims 1 and 11, and claims 2, 4, 5, 7-10 and 42, and 12, 15-16, 18-21 and 43 respectively depending therefrom, are patentable over *Lee* in view of *Yu*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

B. 35 USC §103 Claims 6 and 17

Claims 6 and 17 stand rejected under 35 USC §103 in view of *Lee* in view of *Yu*, as applied respectively to claims 1-5 and claim 11 above, and further in view of U.S. Patent No. 5,348,614 issued September 20, 1994, to *Jerbic* (hereinafter *Jerbic)*. The Applicants respectfully disagree.

Independent claims 1 and 11, from which claims 6 and 17 respectively depend, recite limitations not taught or suggested by any combination of *Jerbic*, *Yu*, and *Lee*. The patentability of claims 1 and 11 over *Lee* in view of *Yu* has been discussed above. *Jerbic* is cited to show that optical filters may be used to filter out certain wavelengths emitted by a particular species. However, *Jerbic* fails to teach or suggest the limitations recited in independent claims 1 and 11 that were shown to be deficient in both *Lee* and *Yu* (alone or in combination).

Accordingly, the teachings of *Jerbic* cannot be used to modify *Lee* or *Yu*, alone or in combination, in a manner that yields an etch endpoint detection process that includes directing radiation onto the substrate as the (high-k dielectric) material layer is etched, wherein the radiation has a wavelength in nanometers that is on the order of the initial thickness of the material layer in Angstroms, measuring a change in intensity for radiation reflected from the substrate at a pre-selected wavelength as the material layer is etched and terminating the etch step upon measuring a predetermined metric for the change in intensity of radiation reflected from the substrate at the pre-selected wavelength, as recited in claim 1; or directing radiation onto the substrate as the (high-k) gate dielectric layer is etched, wherein the radiation has a wavelength in nanometers that is on the order of the initial thickness of the gate dielectric layer in Angstroms, measuring a change in intensity for radiation reflected from the substrate at a pre-selected wavelength as the gate dielectric layer is etched; and terminating the etch step upon measuring a predetermined metric for the change in intensity of radiation reflected from the substrate at the pre-selected wavelength, as recited in claim 11. Therefore, a *prima facie* case of obviousness has not been established because the combination of *Lee, Yu,* and *Jerbic* fails to yield each of the limitations recited in independent claims 1 and 11, and all claims depending therefrom.

Thus, claims 6 and 17 are patentable over *Lee* in view of *Jerbic*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

<u>C. 35 USC §103 Claims 3 and 42; 13-14 and 43; 44-46 and 48-51</u>

Claims 3 and 42, as applied to claim 1 above; 13-14 and 43, as applied to claim 11 above; and 44-46 and 48-51 stand rejected as being unpatentable over *Lee* in view of *Yu*, and further in view of United States Patent No. 6,518,106 B2 issued February 11, 2003 to *Ngai et al.* (hereinafter *Ngai*). The Applicants respectfully disagree.

Independent claims 1, 11, and 44 recite limitations not taught or suggested by any combination of the cited art. The patentability of independent claims 1 and 11, and all claims depending therefrom, over *Lee* in view of *Yu* has been discussed above. Claim 44 recited similar limitations and further recites directing radiation onto the substrate as the material layer is etched, wherein the radiation has a wavelength of

between about 200 to about 800 nanometers and wherein the thickness of the material layer is between about 5 to about 300 Angstroms.

The Examiner cites *Ngai* to show that the dielectric may be hafnium dioxide and that a hafnium dioxide layer may be formed to approximately 15 – 50 Angstroms. However, *Ngai* fails to teach or suggest a modification of the teachings of *Lee* and *Yu* that would result in an etch endpoint detection process that includes directing radiation onto the substrate as the material layer is etched, wherein the material layer is a high-k dielectric material layer, or wherein the radiation has a wavelength in nanometers that is on the order of the initial thickness of the material layer in Angstroms, as recited in claim 1, or directing radiation onto the substrate as the gate dielectric layer is etched, wherein the gate dielectric layer is a high-k gate dielectric layer, or wherein the radiation has a wavelength in nanometers that is on the order of the initial thickness of the gate dielectric layer in Angstroms, as recited in claim 11. Therefore, a *prima facie* case of obviousness has not been established because the combination of *Lee* and *Ngai* fails to yield each of the claimed elements of independent claims 1 and 11, and all claims depending therefrom.

Thus, claims 3, 13-14, 42-46, and 48-51 are patentable over *Lee* in view of *Yu*, and further in view of *Ngai*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

D. 35 USC §103 Claim 47

Claim 47 stands rejected as being unpatentable over *Lee* in view of *Yu* and *Ngai*, as applied to claim 44 above, an further in view of *Jerbic*. The Applicants respectfully disagree.

Independent claim 44, from which the above-rejected claim depends, recites limitations not taught or suggested by any combination of the cited art. The patentability of independent claim 44, and all claims depending therefrom, over *Lee* in view of *Yu* and *Ngai* has been discussed above. As also discussed above, *Jerbic* is cited to show that optical filters may be used to filter out certain wavelengths emitted by a particular species. However, *Jerbic* fails to teach or suggest the limitations recited in independent claim 44 that were shown to be deficient in any combination of *Lee*, *Yu*, and *Ngai*.

Accordingly, the teachings of *Jerbic* cannot be used to modify *Lee*, *Yu*, and *Ngai*, in a manner that yields an etch endpoint detection process that includes providing a substrate comprising a material layer having an initial thickness, wherein the material layer is a high-k dielectric material layer; etching the material layer on the substrate; directing radiation onto the substrate as the material layer is etched, wherein the radiation has a wavelength of between about 200 to about 800 nanometers and wherein the thickness of the material layer is between about 5 to about 300 Angstroms; measuring a change in intensity for radiation reflected from the substrate at a pre-selected wavelength as the material layer is etched; and terminating the etch step upon measuring a predetermined metric for the change in intensity of radiation reflected from the substrate at the pre-selected wavelength., as recited in claim 44. Therefore, a *prima facie* case of obviousness has not been established because the combination of *Lee, Yu, Ngai,* and *Jerbic* fails to yield each of the limitations recited in independent claim 44, and all claims depending therefrom.

Thus, claims 3, 13-14, 42-46, and 48-51 are patentable over *Lee* in view of *Yu*, and further in view of *Ngai*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

CONCLUSION

The Applicants submit that all claims now pending are in condition for allowance. Accordingly, both consideration of this application and swift passage to issue are earnestly solicited. If the Examiner believes that any unresolved issues still exist, it is requested that the Examiner telephone Alan Taboada at (732) 935-7100 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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